

The Numbat (*Myrmecobius fasciatus*) was already scarce when I went to Northam, but night sightings in the head lights of a car were occasionally reported. Little information is available about the early population of the Numbat, but it must have been quite common in parts of the Wheatbelt as the following notes from Koorda (Best, 1930) indicate: "I have caught hundreds of Numbats and once made a cloak of 42 skins. I saw one recently but there are few about here now."

The only animals which I kept in captivity besides Dalgites were Echidnas (*Tachyglossus aculeatus*) which were widespread in the 1930's and can still be found in many timbered areas. None of my pets would feed on anything but termites and steadfastly refused to take ants or other substitutes, including egg flip, although subsequently I have seen many individuals drink this with apparent relish. Keeping up the food supply presented considerable difficulties and quite often I took the Echidna through the bush on horse back in search of termite mounds or infested logs. When offered a suitable nest the animal would quickly break through the earthen walls with its strong front claws and probe the exposed galleries with its long flickering tongue. Although the Echidna seemed unconcerned at dangling from my saddle in a sugar bag the horse was less phlegmatic and deeply resented the needle-like spines which occasionally pricked its flanks.

After several months convenient termite material became so scarce that the Echidna was released to fend for itself and soon after that I left the district.

Although stretches of bushland still remain in National Parks and Forestry and Fauna Reserves west of Toodyay, no worthwhile areas were set aside in the agricultural sections of the Avon Valley and so the early profusion of pink everlastings and golden jam blossoms is now replaced each spring by the pink of Cape Tulip (*Homeria spp.*) and a purple haze of Paterson's Curse (*Echium spp.*). Each year the road verges and the river banks lose more trees and the inexorable march of progress takes its toll.

Suggestions that much of the Avon Valley be declared an integrated National Park, as has been done with some rural areas in Britain, raise serious problems, but unless drastic action is taken soon, the Avon River will become little more than a drainage channel and the "Valley" will lose what remains of its original charm.

REFERENCES

- Anon., 1930. *Elders Weekly*, published by Elder Smith & Co., now Elders-GM., Perth.
Best, G., 1930. Personal communication.
Haddleton, J. F., 1952. *Katanning Pioneer*, p.88.
Leake, Bruce W., 1961. *Reminiscences*, privately published.
Leake, Bruce W., 1962. *Eastern Wheatbelt Wildlife*, p.50 privately published.
Schmidt-Nielsen, K., 1964. *Desert Animals*, Oxford at the Clarendon Press, p.137.
Smyth, D. R. & Philpott, C. M., 1968. A Field Study of the Rabbit Bandicoot, *Macrotis lagotis*, Marsupialia, from Central Western Australia. *Trans. Roy. Soc. S. Aust.*, 82: 9.

OBSERVATIONS ON THE WANDERER BUTTERFLY IN WESTERN AUSTRALIA

By B. DELL, Botany Department, University of Western Australia

SUMMARY

From populations of the Wanderer near Perth, information on breeding of the adult and behaviour of the larva were obtained. The effect of temperature on pupation time was determined under controlled conditions. Preliminary results conflict with theories proposed for the Monarch in North America.

INTRODUCTION

After its arrival in Australia about 1870 the Wanderer Butterfly, *Danaus plexippus plexippus*, spread rapidly on the mainland, flourishing best where introduced cotton plants, *Asclepias*, were abundant. J. Burton

Cleland and H. M. Giles recorded the Wanderer from the north-west of Western Australia in 1907 (Cleland and Giles, 1909; Walker, 1915), 21 years before Pearce (1938) observed it in Tasmania. The more recent appearance of the Wanderer in the south-west of Western Australia has been documented by Koch (1971, 1973). Although the Wanderer is capable of flying long distances it is probable that its early occurrence in the north-west was facilitated by the presence of suitable food-plants across subtropical Australia.

All the Western Australian native species of *Asclepiadaceae* (about 20) occur in the northern and eremian botanical provinces. Larvae of the Lesser Wanderer (*Danaus chrysippus petilia*) reportedly feed on species of *Pentatropis*, *Marsdenia* and *Leichardtia* as well as on introduced *Asclepias*. It seems likely that the Wanderer could breed on the same genera as the Lesser Wanderer. Introduced species of *Asclepias*, *Calotropis* and *Araujia* have been recorded by various authors as food-plants of the Wanderer. *Calotropis gigantea*, an introduction from Africa, is now common in disturbed areas of tropical W.A.

In the south-west the Wanderer is dependent on introduced species of *Asclepias*, mainly *A. fruticosa*, for its survival. Although large populations of this noxious weed exist (Meadly, 1971), the future size of the Wanderer population will depend on the extent of *Asclepias* eradication programmes.

Although some aspects of the Wanderer's behaviour, such as overwintering (Smithers, 1966; Common and Waterhouse, 1972), are present in both Australia and North America, the complicated pattern of behaviour associated with migration in North America (Williams, 1930) is poorly developed in Australia. This paper documents some basic information as a foundation for future work.

OBSERVATIONS

In the Perth metropolitan area the Wanderer can be seen throughout the year, but during the winter months only on warm sunny days. The greatest numbers have been seen in autumn particularly along the Canning River and near breeding sites in the foothills of the Darling Range. Breeding populations have been seen near Midland, 5 km east of Kalamunda, along the Canning River at Kelmseott, along Neerigen Brook at Armadale, and near Byford. All reproductive stages were present through autumn and winter. Larvae and pupae of the Lesser Wanderer were also present throughout this time. Although the food-plant occurs further south towards the Serpentine River, immature stages of the Wanderer were absent.

Most observations took place at the Kalamunda site from May 1972 to July 1973, and were supplemented by occasional visits to the other populations. At the main locality the food-plants occupy about 0.2 hectare of grazing land merging into more natural vegetation dominated by *Eucalyptus rudis* along an ephemeral creek bed. The population also extends into thickets of *E. calophylla* on uncleared land.

Adults were reared from eggs on fresh shoots of *A. fruticosa* in experimental cages in the laboratory. Caterpillars in the fourth and final instars were collected from the field and the resulting pupae used in temperature experiments.

Egg

In spite of the wet winters characteristic of the Perth area breeding occurs throughout the year on the food-plants which do not die back during the winter. Freshly laid Wanderer eggs were collected in July 1972. The eggs are laid on terminal shoots, usually on the leaves but not uncommonly on the spiny fruits. The distribution of eggs on the leaves of one sample collected was as follows: adaxial surface — 13 (4 on midrib); abaxial surface — 73 (5 on midrib, 42 on axial half of leaf). Each leaf had one egg except for three leaves which had two eggs.

Larvae

Larvae of the Wanderer are more abundant than those of the Lesser Wanderer and the two species randomly occur on the same or separate

plants. Both species feed on the abaxial surface of the leaf and at early stages of development feed through to the adaxial epidermis. Later the leaf may be eaten distally from the apex including the midrib. When food is scarce the larvae hollow out the soft fruits. If food becomes limited in experimental cages larvae are incapable of pupating prematurely.

Body patterns appear in the second instar as light brown stripes. By the fifth instar these stripes have become brownish-black and the now smooth body is supplemented with a secondary banding of yellow and white. Apart from a considerable amount of variation in the width of the dark bands, a regular variation in the secondary banding can be discerned (Fig. 1). Most of the variation is attributable to creamy-white abdominal bands. These bands appear in three forms (a) complete, (b) dissected or broken, and (c) absent. The mesothoracic regions of (c) are much darker than (a) or (b) due to greatly reduced banding. The first type is the most abundant, the other two rarer and approximately equal. Urquhart (1960) mentions variation in banding of the larva but does not go into detail.

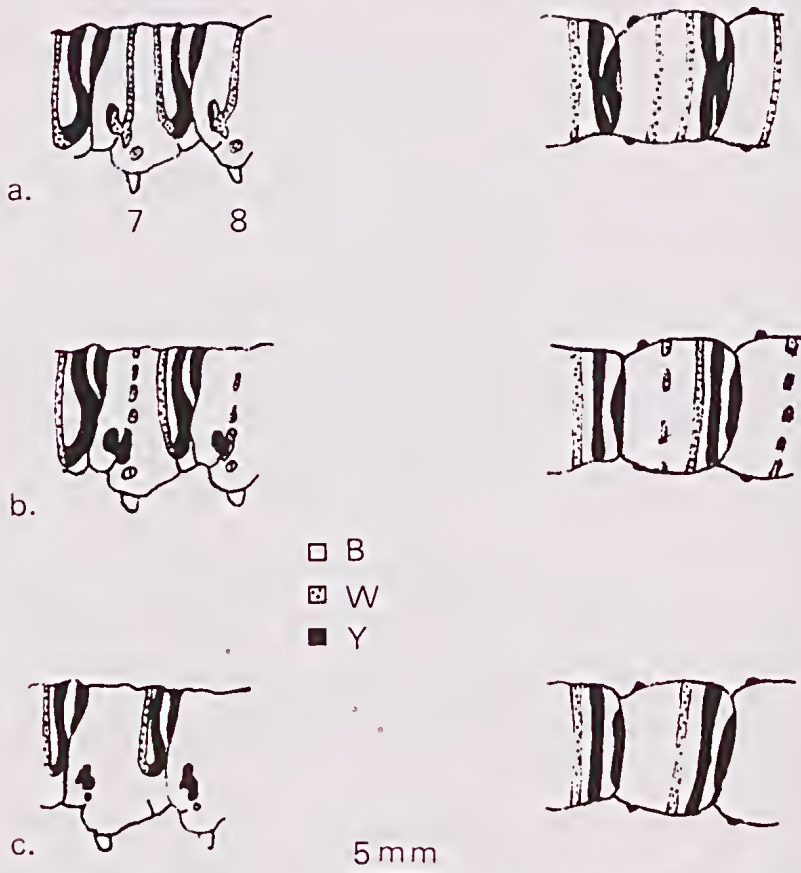


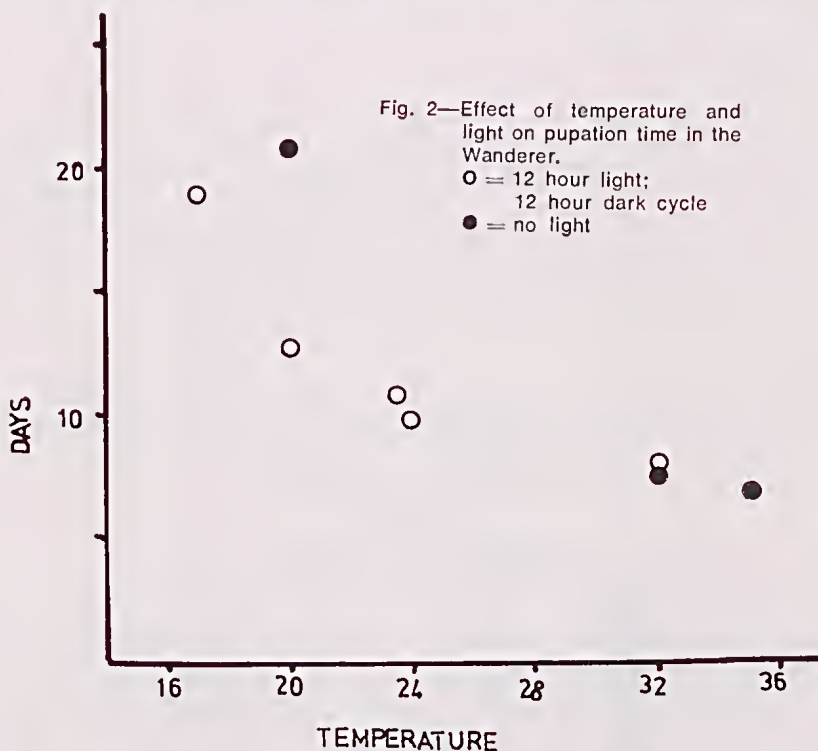
Fig. 1.—Abdominal body patterns in the larvae of the Wanderer (B: brownish-black, W: white, Y: yellow).

Adult variation in colour pattern could not be associated either with larval variation or sex of the adult. Arcas examined included the distal light blue patch ventrally within the cell, spots on the terminal edge of the forewing, and ventral white spots at the apical-costal border of the hindwing and the tornus of the forewing.

Pupa

During the nomadic stage of pupation the larvae of the Wanderer have been noted to display negative phytotaxis (McCubbin, 1971; Urquhart, 1960). As a result the chrysalis are rarely found on the food-plant. At the Kalamunda site pupae commonly occur on *Asclepias* and on the surrounding vegetation. On 2 June 1973 pupae were present as follows: *A. fruticosa*—10 (3 on one bush); *Eucalyptus rudis*—3; *Lepidospermum tetraquetrum*—6; *Agonis linearifolia*—1. Pupae have also been seen on *Juncus pallidus*, *E. calophylla* and various grasses. Pupae usually occur less than one metre from the ground but may be higher on taller *Asclepias* bushes. Pupae were also evident on *Asclepias* at other times of the year. Possibly larvae move from the bush on which they last fed to another of the same species to pupate. Urquhart records that of 63 pupae collected only 4 occurred on milkweed.

The effect of temperature on pupation time is shown in Fig. 2. Each sample is the mean of about 10 pupae. The adults emerge after about eight days at 30°C but at 18°C the time increases to about nineteen days. Urquhart states that pupae take nine to fifteen days to develop whereas Coleman (1939) states that the pupal stage lasts fifteen to twenty days. Fig. 2 shows that time is largely dependent upon temperature.



Development completely stopped when pupae from the experimental cages were placed at 10°C under constant fluorescent light. After being transferred to 20°C after one to twenty two days at 10°C pupae took the same time to develop as those not given the cold treatment. The emerging adults were quite normal even if pupae had been allowed to develop for several days before the cold treatment. It appears that temperatures below 10°C would cause cessation of the development of the imago at the pupal stage in the field and that short periods of cold weather would have no harmful effects but merely delay the emergence of the adult.

Adult

After the adult has emerged from the pupal case the wings take about ten to twenty minutes to reach maximum size. Unless the butterfly is able to find a support to enable the wings to hang down during this time, the wings become permanently distorted. One male Wanderer with unhardened wings was seen on an overcast day in June when light rain was falling and the temperature was 14°C. Newly emerged adults have been seen in August.

Urquhart records that the Monarch emerges during daylight hours particularly at noon. He states, "Presumably some light-perception mechanism controls the rate of development, allowing more rapid development on bright, sunny days, less on cloudy days, and virtually no development during periods of darkness." The conclusion he draws is that temperature is not a main controlling factor. The data shown on Fig. 2 indicate that at warm temperatures, development is independent of light, the adults emerging in total darkness. Temperature here appears to be the controlling factor. However, at 20°C the pupation time is increased by the absence of light. Both temperature and light are thus important in the development of the adult. No doubt, under field situations interaction of factors occurs with the possibility of different limiting factors as environmental parameters change.

A sample of pupae yielded 35 males and 42 females. This result is not significantly different from a sex ratio of one.

Mortality

The larvae generally seem to be free from predators, particularly vertebrates which are susceptible to cardiac glycosides. An assassin bug, *Melanerythrus mactans*, was seen sucking the contents of a young caterpillar of about the third instar. Four Wanderer pupae on *E. rudis*, *Juncus* and *Lepidospermum* and one Lesser Wanderer pupa contained parasite larvae of a tachinid fly. The eggs are presumably laid on the host caterpillar and these hatch at the time of pupation. No pupae on *Asclepias* were parasitised. Rainbow (1907) and McCubbin (1971) both state that larvae which pupate on the food-plant are frequently parasitised.

Habitat

As well as the Wanderer and Lesser Wanderer a species of aphid is common on terminal shoots of *Asclepias*. The aphids are a source of food for two species of ladybird, *Menochilus 4-pustulatus* and *Coccinella repandra*, and the larvae of a syrphid fly, *Ischiodon scutellaris* (Fig. 3a). A parasite wasp, *Diplazon laetatorius* (= *Bassus*), can be found as an endoparasite of this syrphid on *Asclepias* (Fig. 3b).

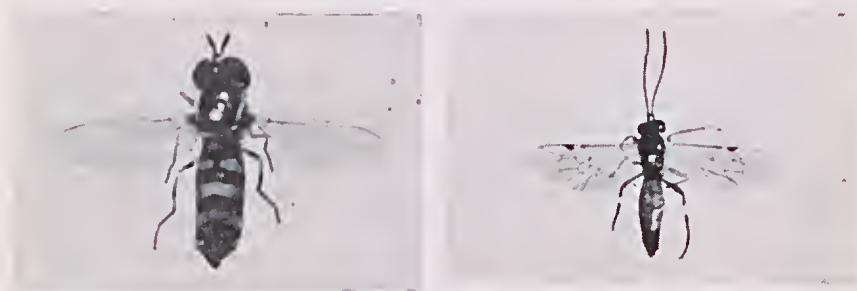


Fig. 3.—Left, *Ischiodon scutellaris*; right, *Diplazon laetatorius*.

CONCLUSION

The behaviour and biology of the Wanderer near Perth are different in some respects from those of the Monarch in North America. Some

variation can probably be related to differences in environment and the relative new and small population in Western Australia.

The Wanderer has established itself in the Perth metropolitan and adjacent areas and numbers are increasing. It will be interesting to see if the breeding range extends into country areas where *Asclepias* is known to occur (e.g. Meadly, 1971). Broods occur throughout the winter. When there are sufficient consecutive sunny days egg-laying takes place. It is doubtful whether areas exist where adults can retire for the winter months. The population is at present too small for clustering to occur. This behaviour is unnecessary as larval stages are present throughout the unfavourable times of the year.

Another interesting observation is that the Lesser Wanderer and the Wanderer appear to occupy almost the same ecological niche. More information is required on the two species before this can be substantiated.

ACKNOWLEDGEMENTS

I would like to thank Miss Kay Elson for her valuable assistance. Officers of the CSIRO Entomological Division, Canberra, the W.A. Museum and the W.A. Department of Agriculture helped in the identification of specimens.

REFERENCES

- Cleland, J. Burton, and H. M. Giles. 1909. A scientific trip to the North Coast of Western Australia. *J. W.A. Nat. Hist. Soc.*, 2 (6):45-63.
Coleman, E. 1939. Notes on the Wanderer butterfly (*Danaus archippus*) in Australia. *Vict. Nat.*, 4.
Common, I. F. B., and D. F. Waterhouse. 1972. *Butterflies of Australia*. Angus & Robertson.
Koch, L. E. 1971. The Wanderer Butterfly in Western Australia. *W.A. Nat.*, 12: 25-27.
Koch, L. E. 1973. Wanderer Butterfly Sightings in Western Australia. (September 1971 to May 1972). *W.A. Nat.*, 12: 115.
McCubbin, C. 1971. *Australian Butterflies*. Nelson.
Meadly, G. R. W. 1971. Cotton Bush (*Asclepias fruticosa* L.). Garden plant now a noxious weed. *J. of Agric. W.A.*, 12: 65-68.
Pearce, D. C. 1938. In Dannreuther, T. *Danaus plexippus* L. taken in Tasmania. *Entomologist*, 71: 237.
Rainbow, W. J. 1907. *A Guide to the Study of Australian Butterflies*. T. C. Lothian, Melbourne.
Smithers, C. N. 1965. A note on overwintering in *Danaus plexippus* (L) (Lepidoptera : Nymphalidae) in Australia. *Aust. Zool.*, 13: 135-136.
Walker, J. J. 1915. A note on the distribution of *Danaida plexippus* in Australia. *Ent. Mon. Mag.*, 51: 294-295.
Williams, C. B. 1930. *Migration of Butterflies*. Edinburgh.
Urquhart, F. A. 1960. *The Monarch Butterfly*. Toronto.

THREE STONE IMPLEMENTS FROM TOODYAY, WESTERN AUSTRALIA.

By KIM AKERMAN, Derby.

ABSTRACT

That stone implements were used in the preparation of hides by Aboriginal Australians has been well documented in the early literature. Apart from the reniform slate scrapers of South Australia, however, no other skin 'scraper' forms appear to have been recognized. Discussed are two such implements from the south-west of Western Australia. One of the scrapers is a multi-purpose tool combining the functions of core adze and hide scraper. A third implement, a core adze, is also discussed.

INTRODUCTION

The three artefacts discussed are surface finds; collected during a geological field trip in May 1970. The trip involved mapping the geology of an area five miles south-east of Toodyay, a town fifty miles east of Perth. It is hoped to show how two implements entirely different in mode of manufacture and function are combined in a third multi-purpose stone implement.

DESCRIPTION

The artefacts are made of dolerite from dykes that intrude Precambrian granitic and metamorphic rocks in south-western Western